

THE USE OF AI IN THE PROCESS OF INTERACTIVE MULTIMEDIA E-LEARNING COURSE DEVELOPMENT

El uso de IA en el proceso de desarrollo de cursos de aprendizaje electrónico multimedia interactivos

Biziuk Andrii¹, Ippolitova Veronika¹

¹ Department of Media Systems and Technologies, Kharkiv National University of Radio Electronics, Ukraine
andrii.biziuk@nure.ua; veronika.ippolitova@nure.ua

Abstract

This paper examines the transformative impact of artificial intelligence on education, with particular emphasis on its application in multimedia e-learning courses. The integration of artificial intelligence into the design of electronic multimedia e-learning courses creates new possibilities for personalized learning and significantly enhances the overall effectiveness of the educational process. AI-driven solutions promote deeper understanding and foster greater learner engagement. The inclusion of interactive, AI-powered components provides ongoing support and broadens opportunities for autonomous learning. As a result, artificial intelligence emerges as a key instrument in the development of innovative educational environments that meet the evolving needs of a contemporary society. The study also addresses ethical issues and data security risks related to AI use.

Keywords: Artificial intelligence, e-learning courses, educational technologies, AI tools, interactive content.

Introduction

The growing reliance on digital technologies has fundamentally reshaped education. Among the most effective formats for e-learning are multimedia-rich courses that combine visuals, sound, animation, and interactive elements. These features not only make content more appealing but also improve the learner's ability to grasp and retain complex ideas through active engagement.

The landscape of e-learning has significantly evolved, transitioning from simple, static text formats to dynamic, multimedia-rich environments. A major force behind this evolution is artificial intelligence (AI), which elevates the learning experience through increased personalization, interactivity, and overall effectiveness. Interactivity plays a crucial role in this process, transforming learners from passive recipients into active participants through tools like real-time feedback, gamification features, and responsive assessments. Incorporating AI tools into the creation of interactive multimedia e-learning courses enhances student engagement even more, boosts information retention, and addresses the shortcomings of traditional educational software.

Main purpose and objectives of the work

Purpose: to consider various ways to use artificial intelligence to develop interactive multimedia e-learning courses – from planning and content creation to implementation and optimization stages.

Objectives: to identify the difference between traditional development and the use of AI; to consider at which stages of the development of interactive multimedia courses it is possible to apply AI tools; to determine how artificial intelligence can optimize course creation, enhance personalization, and improve learning outcomes; to consider the set of AI tools in the development process; to analyse the prospects for the application of AI in the future and the possibilities of eliminating existing shortcomings.

Literature review

Nowadays, emerging technologies, particularly artificial intelligence, are profoundly reshaping the nature of creative processes. Computers have become essential tools in a wide range of creative domains, including music, architecture, visual arts, and scientific research (Kaluhin & Vovk, 2024). Moreover, the rapid development of technologies based on artificial intelligence is driving increased interest in chatbots as a tool for remote learning. It is evident that chatbot technology has a significant impact on overall learning outcomes (Slisarenko, 2024). The integration of AI into e-learning has emerged as a promising approach to addressing the limitations of traditional online education. The research paper by Tanjga (2023) explores the current landscape of e-learning and the application of AI in educational settings, with particular attention to the advantages, challenges, and ethical implications of AI usage. Furthermore, the author analyses the potential impact of AI on student learning outcomes and examine the evolving role of educators in the effective integration of AI technologies into e-learning environments (Tanjga, 2023). It is important to emphasize that the covid-19 pandemic brought significant disruptions to the global education sector. The abrupt transition to online learning presented both challenges and opportunities, prompting many institutions to adopt AI technologies to enhance the e-learning experience. The study by Dragan et al. (2023) investigates the development of AI in e-learning during the pandemic, highlighting its advantages as well as the obstacles encountered in its implementation. A study by Jannathul Firthous et al. (2024) explored the potential of an AI-driven e-learning platform designed to provide a more personalized, adaptive, and effective learning experience for students. The researchers found that by leveraging data analytics, the platform can monitor individual learning patterns, identify students' strengths and weaknesses, and tailor content to match their pace and level of understanding. It incorporates features such as intelligent tutoring systems, automated feedback, and real-time assessments to support effective mastery of subject matter. Furthermore, AI-powered tools enhance the learning experience by recommending supplementary resources, offering interactive simulations, and facilitating collaborative opportunities, thereby making the educational process more engaging and dynamic. Ultimately, the platform seeks to optimize learning outcomes and improve overall student performance (Jannathul Firthous *et al.*, 2024). Mudita et al. (2023) emphasize that, like other technologies, artificial intelligence must be adapted to meet the specific needs of individual organizations. What proves effective for one organization may not be suitable for another, highlighting the importance of implementing meaningful and context-specific automation. However, as with most technological advancements, the adoption of AI also introduces several risks – particularly concerning data security and storage. Given that AI systems frequently handle sensitive information, it is essential to implement robust security measures to prevent data breaches, which pose serious threats to organizational integrity (Mudita *et al.*, 2023).

To sum up, the integration of artificial intelligence into various sectors, particularly education, is transforming traditional approaches and opening new opportunities for personalized, efficient, and engaging learning. AI-powered tools such as chatbots, intelligent tutoring systems, and adaptive platforms are significantly enhancing the quality of e-learning. Research findings highlight not only the benefits but also the challenges and ethical concerns that come with AI implementation. The covid-19 pandemic has further accelerated the adoption of AI technologies, reinforcing their role in shaping the future of education. However, to fully realize the potential of AI, it is essential to ensure data security, adapt solutions to organizational needs, and support educators in their evolving roles. Ultimately, AI should be seen as a complementary tool that enhances, rather than replaces, human-led educational processes.

Differences between traditional course development and AI-assisted development

In traditional course development, the process typically involves:

- Manual content writing and structuring, which can be time-consuming and resource-intensive. Manual course creation requires a lot of time and coordination, especially when developing high-quality, well-structured learning materials.
- Manual design and multimedia creation often requiring significant effort from multiple individuals. Designing visuals and creating multimedia content often involves several specialists and takes a significant amount of effort.
- Static assessments, which have limited ability to adapt to individual learners' needs. Traditional assessments are usually fixed and cannot adapt to the learner's performance or learning pace.
- Extensive human involvement in revisions and improvements to ensure content quality and relevance. Content updates and improvements often require a team of educators and editors to ensure accuracy and relevance.



However, with AI-assisted development, the process becomes much more efficient:

- AI can generate text and structure course modules automatically, saving valuable time. AI can automatically generate and organize course content, significantly reducing development time.
- Automated multimedia production tools, such as text-to-speech and AI-generated videos, speed up the creation of engaging content. AI tools like text-to-speech and video generators simplify and speed up the production of multimedia elements.
- AI enables personalized and adaptive assessments that can adjust to the learner's progress and needs. AI enables dynamic quizzes and tasks that adjust to each learner's strengths, weaknesses, and progress.
- AI-driven insights help optimize the course, providing continuous feedback for improvement. AI analyses learners' data to provide feedback and recommendations, helping to continuously enhance the course.

To overcome the challenges associated with traditional course development, we can implement AI in several key areas. By integrating AI into the development process, we can automate time-consuming tasks such as content creation and multimedia production, enhance personalization through adaptive assessments, and leverage data-driven insights for continuous course optimization.

The integration of AI into the design process

It is important to note that designers invest a significant amount of time in the creation and development of design variations, relying on a combination of hybrid-creative and logical thinking. In contrast, AI operates based on hyper-logical systems that predominantly lead to predictable outcomes. However, this modern technology offers new opportunities for designers by enabling more informed and well-grounded decision-making.

The integration of AI into the design process brings several advantages (Bakalenko & Ippolitova, 2024):

- it enables the analysis and generalization of current design trends, helping to identify the most relevant and in-demand directions;
- it assists in detecting design-related issues, thus guiding designers in the right direction when solving complex tasks;
- it enhances productivity by automating routine tasks such as template generation, layout optimization, and compliance checking, allowing designers to focus more on the creative aspects of their work;
- it supports the personalization of user interfaces by analysing user data and generating unique designs that improve user experience and increase product engagement;
- it optimizes user interaction by analysing user behaviour and improving interface usability through the processing of large volumes of analytical data;
- it reduces the number of errors and deficiencies in design outputs by automating certain aspects of the process, thereby increasing the overall quality and reliability of the product;
- it fosters the development of new technologies and design approaches, enabling the creation of innovative and cutting-edge solutions.

Nevertheless, when utilizing AI, it is crucial to recognize that, unlike human input, neural networks often struggle to comprehend the core idea or the underlying user need. To meet client expectations effectively, it is essential to formulate precise prompts, allowing the neural network to respond appropriately and generate relevant results. Professional designers who understand these nuances can skilfully leverage AI tools to achieve impressive outcomes. Although neural networks are continuously improving, it remains important to clarify details and follow a proper methodology when using their algorithms in order to unlock their full potential.



Despite its numerous benefits, AI can also present drawbacks, which may manifest as defects in the final output. Improperly formulated prompts can lead to multiple issues in the generated images. Even when such defects are identified, correcting them may pose a challenge for the AI system, as the algorithm may misinterpret the context or specific details. In such cases, designers play a critical role in refining the outcome, using their expertise and manual editing skills to correct and improve the visuals. Additionally, neural networks often face difficulties in generating human figures, combining images with text, or applying textures and surface details in a natural way. In these scenarios, the neural network may invent additional context or elements, effectively acting as a creative entity. The designer, in turn, can either accept these decisions or make adjustments by refining the input prompts or manually editing the generated content.

Key stages of development where AI is used

Planning Stage. AI tools can help instructional designers analyse learner needs, preferences, and learning behaviours by processing large amounts of data from previous courses or learners' feedback. This allows for more targeted course objectives and better-aligned content.

For instance, AI can suggest optimal navigation paths based on how learners typically interact with content, ensuring smooth transitions between topics and activities. It can also automate the organization of course materials, helping to create a coherent flow that enhances the learner experience.

In the planning stage, AI not only helps structure the course but also enables the creation of a prototype. By leveraging AI, instructional designers can quickly generate a functional prototype of the course, allowing them to visualize the overall structure, to quickly test and refine the course architecture before full-scale development begins, saving valuable time and resources.

Content creation stage. AI plays a significant role in optimizing the development of course materials. AI plays a crucial role in the development of interactive educational materials, facilitating the generation of educational videos (including avatars, subtitles, and translations, if needed), audio materials (not only for exercises but also background music and narration), and graphical elements such as animations. On top of that, AI also helps in outlining course aims, allowing designers to define clear and measurable objectives that match learners' needs. It also helps generate clear instructions, ensuring that task instructions are easy to follow and free from confusion.

First and foremost, outlining course aims becomes much more efficient with AI. It assists instructional designers in clearly defining and outlining course objectives and tasks. By leveraging AI, the goals are not only precise and measurable but also fully aligned with learner outcomes, ensuring that the content addresses the needs of the students effectively.

When it comes to generating clear instructions, AI can help in creating standardized, concise guidelines and task completion algorithms. This reduces the risk of misunderstandings and ambiguities in the course content, providing students with clear expectations and instructions.

In terms of engagement, AI-generated narration and voiceovers enhance the learner experience. AI can automatically generate high-quality voiceovers, making the course materials more accessible and engaging. Additionally, AI can generate multi-language voiceovers, providing support for a diverse, global learner base.

For visual content, AI-driven video and animation tools can create dynamic, interactive learning experiences. These tools allow for the automatic generation of videos and animations that can bring complex concepts to life, making them easier to understand and more engaging for students.

In the area of image and graphic design, AI plays an essential role in assisting instructional designers with the creation and optimization of images, graphics, and other visual elements.

Programming and Implementation Stage, where AI helps address design challenges and improve course functionality. One area where AI proves particularly useful is overcoming limitations in e-learning software, such as Adobe Captivate. While Adobe Captivate is a powerful tool for creating interactive courses, it can sometimes fall short when it comes to advanced customizations.

In such cases, AI can assist by integrating custom HTML and JavaScript code into the course design, enabling more flexible and dynamic functionality. Rather than requiring extensive time to manually program complex logic, AI offers a faster and more efficient alternative, allowing instructional designers to seamlessly implement advanced features like gamification – incorporating elements such as choosing avatars, obtaining badges, progress tracking, interactive challenges or hidden levels.



Experimental section

In the context of learning personalization, AI plays a vital role in tailoring the learning experience to individual students. First, AI provides personalized learning recommendations by analysing students' preferences, abilities, and performance, offering study modules best suited to their needs. Additionally, AI evaluates open-ended responses, ensuring they meet the required criteria and suggesting improvements, thus providing students with actionable feedback to enhance their learning process.

The authors of this work tested the use of specific AI tools in the process of designing the electronic multimedia educational resource "Sprachenvirtuose: Interaktives Deutschtraining für Fortgeschrittene" using Adobe Captivate. The main features implemented during the development of the electronic multimedia educational resource included:

Creating accurate and standardized task formulations, along with explanations of task execution algorithms, to avoid misunderstandings and ambiguity. The use of AI enabled the generation of clear, concise, and standardized task instructions that eliminate ambiguity. This ensures that learners fully understand the task requirements and can complete them without confusion. Moreover, AI helped provide consistent language throughout the course, contributing to a more professional and polished learning experience. The explanations of task algorithms were also improved for better learner comprehension.

Artificial intelligence is increasingly recognized as a transformative force in instructional design, particularly in the creation of multimedia-rich educational materials.

During the content development phase of an e-learning course, a range of AI-driven tools was employed to streamline production and improve pedagogical effectiveness. High-quality voice synthesis allows educational content to be delivered in a clear and natural manner, and the availability of multilingual output further supports inclusive learning for diverse, global audiences. For instance, ElevenLabs was utilized to generate naturalistic voiceovers from text-based scripts. The tool enabled the delivery of narration in multiple languages and vocal styles, contributing to an accessible and professional auditory learning experience (see Fig. 1).

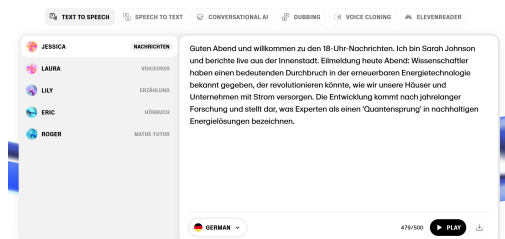


Figure 1. Production of audio narration with the option to select various voices and languages for a given text.
Source: ElevenLabs: Free Text-to-Speech and AI Voice Generator.

Adobe Express Animate Character was used to generate animated avatars for instructional content. A character could be selected from a built-in library, a background chosen or uploaded, and the canvas size defined. The avatar was then synchronized with the pre-generated voiceover, resulting in a personalized and visually engaging presentation (see Fig. 2).

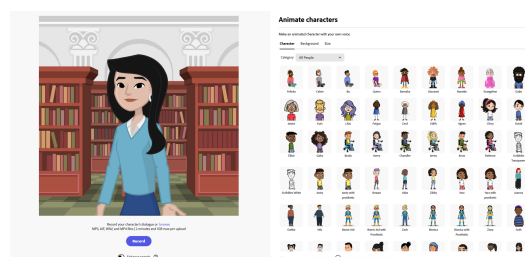


Figure 2. Character speech animation with a wide selection of characters, backgrounds, and canvas sizes
Source: Adobe Express Animate Characters.

In the area of video production, Fliki was applied to transform textual material into fully realized video segments. This process enabled the efficient creation of coherent and visually appealing instructional videos. The platform automatically sourced relevant stock footage or generated visual content, combined it with narration, and allowed for the customization of subtitles and visual styles (see Fig. 3).

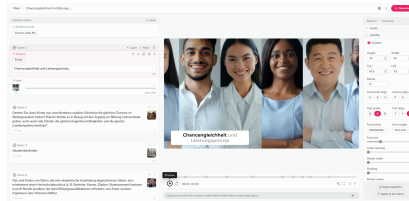


Figure 3. Video creation with voice-over narration, subtitles, and option of selecting or generating video content
Source: Fliki: own elaboration with AI Video Generator.

Additionally, for image and graphic design, Microsoft Copilot was employed to assist in the generation and refinement of visual assets. Through AI-powered suggestions and automation, high-quality graphics were produced to illustrate key concepts and support instructional clarity (see Fig. 4).

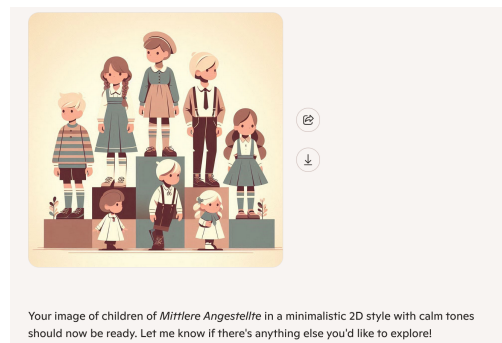


Figure 4. Image generation based on a selected theme
Source: own elaboration with Microsoft Copilot.

Providing personalized learning recommendations: selecting modules (learning paths) to focus on based on the student's preferences, capabilities, and performance. AI tools analysed learners' inputs and performance to suggest the most relevant modules and exercises. These recommendations helped adapt the course content to each individual's needs, goals, and learning pace. As a result, learners could focus on areas that required improvement or matched their interests. This approach fostered a more engaging and efficient learning process.

Evaluating open-ended responses for compliance with requirements and offering suggestions for improvement. AI-assisted evaluation made it possible to review and assess open-ended responses for clarity, relevance, and alignment with the task objectives. The system could also highlight potential areas for improvement and suggest better wording or additional ideas. This helped learners refine their answers and develop critical thinking skills. Additionally, it reduced the instructor's workload in manual grading (See Fig.4).

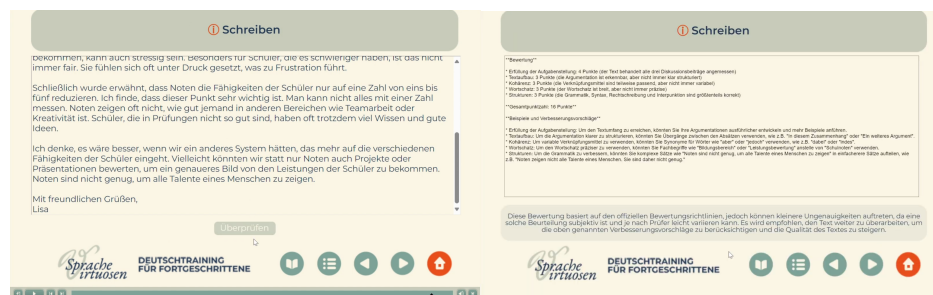


Figure 4. Evaluation of open-ended responses against set criteria and improvement suggestions, providing timely, constructive feedback to support learning.
Source: Own elaboration.

Overcoming Adobe Captivate's limitations by writing custom code using HTML and JavaScript. While Adobe Captivate offers powerful tools for e-learning development, it has certain limitations in interactivity and customization. AI-assisted coding support allowed the author to write and integrate custom HTML and JavaScript code to extend the platform's functionality. This enabled the creation of more dynamic, responsive, and learner-friendly interfaces. It also made possible features that would otherwise be unavailable using only built-in tools (see Fig.5).



Figure 5. Acceleration of the HTML coding process with custom text formatting (e.g., highlighting key words) and the integration of quizzes into the article text using JavaScript tools; integration of gamification elements.
Source: Own elaboration.

Acting as a consultant to assist in developing complex interaction logic. AI acted as a virtual consultant by helping to design and troubleshoot complex interaction scenarios within the course. It provided suggestions on how to structure conditional logic, triggers and advanced actions, and learner paths for a smoother user experience. This support was particularly valuable when implementing non-linear navigation and adaptive feedback systems. The result was a highly interactive and intelligent learning environment.

Future

The future of artificial intelligence (AI) in e-learning is increasingly oriented toward hyper-personalization, where AI-driven adaptive learning experiences are tailored to the specific needs and preferences of individual learners. Supposedly, much like how Netflix or Spotify personalize entertainment, AI-driven recommendation engines will suggest the next best content, learning activities, or peer interactions based on a learner's performance, goals, and preferences. AI will probably facilitate intelligent group formation too, matchmaking learners for collaborative tasks based on skill sets, learning styles, or progress. AI might also mediate communication or offer interventions during group work to maintain balance and productivity. In addition to facilitating personalized learning, AI holds significant potential in supporting educators through the deployment of virtual teacher bots. These AI-powered assistants are capable of guiding students, responding to inquiries, and providing individualized feedback, thereby fostering a more efficient and responsive learning environment.

A particularly promising advancement in this domain is the integration of eye-tracking technology, especially within virtual reality (VR) environments. By monitoring eye movements, AI can gather critical data regarding a learner's focus and engagement levels. This information can then be leveraged to enhance the learning experience, personalize content, and improve accessibility, such as by activating captions for students with hearing impairments. Furthermore, eye tracking can promote deeper immersion in VR environments and facilitate enhanced social interaction in multiplayer VR settings, thus contributing to a more dynamic and interactive learning experience.

Conclusion

The integration of artificial intelligence in the development of electronic multimedia educational courses opens new avenues for personalization and enhances the effectiveness of the learning process. AI-driven tools facilitate deeper comprehension and increase learner motivation. The incorporation of interactive AI-powered elements ensures continuous support for users and expands opportunities for independent learning. Therefore, artificial intelligence serves as a powerful tool in creating innovative educational environments that align with the demands of modern society.

Looking ahead, the role of AI in e-learning is poised to expand further, with the integration of immersive technologies such as augmented reality (AR) and VR, alongside more sophisticated personalization techniques and advanced learning analytics. This evolution will render education more adaptive and impactful, benefiting learners on a global scale.

References

- Bakalenko, O. A. & Ippolitova, V. Ye. (2024). Можливості використання штучного інтелекту в дизайні: переваги та обмеження. Поліграфічні, мультимедійні та web-технології : матеріали Молодіжної школи-семінару IX Міжнар. наук.-техн. конф. Харків. ТОВ «Друкарня Мадрид». 2, 196-197. <https://openarchive.nure.ua/handle/document/26439>
- Dragan, Z., Nebojsa, D., & Kostadinka, S. (2023). An overview of the development of artificial intelligence technology in e-learning during COVID-19. 13th *International Scientific Conference Science and Higher Education in Function of Sustainable Development – SED 2023*, 133-138. <https://sed.akademijazs.edu.rs/fajlovi/papers/proceedings/1-19.pdf>
- Jannathul-Firhous, I. A., Aravind, K., Hemanth, S., & Kathiravan, B. (2024). AI enhanced E-learning platform. *International Research Journal of Modernization in Engineering Technology and Science*, 6, 5640-5644. https://www.irjmets.com/uploadedfiles/paper//issue_11_november_2024/64173/final/fin_irjmets1733038023.pdf
- Kaluhin, N., & Vovk, O. (2024). Artificial intelligence and digital art. *Memoria del primer congreso de artes digitales SYNTOPIA*. Universidad de Guanajuato (Primera Edición). <https://openarchive.nure.ua/handle/document/26189>
- Mudita, S., Leena, N., Fukey, & Ashutosh, S. (2023). AI in e-learning. *Management Studies, D. M. S. D.* https://www.academia.edu/64216261/AI_in_e_learning
- Slisarenko, R. V. (2024). Чат-бот зі штучним інтелектом як засіб дистанційного навчання: вплив на процес та результати Поліграфічні, мультимедійні та web-технології : тези доп. IX Міжнар. наук.-техн. конф. Т. 1. Харків. ТОВ «Друкарня Мадрид». 332-333. <https://openarchive.nure.ua/handle/document/26514>
- Tanja, M. (2023). E-learning and the Use of AI: A Review of Current Practices and Future Directions. *Qeios*. <https://doi.org/10.32388/AP0208>